AWOP News

Area-Wide Optimization Program

Association of State Drinking Water Administrators **Volume 1, Issue 1, February 2004**

An Overview of the Area-Wide Optimization Program

Back in the 90s, as concerns related to microbial contaminants grew, EPA undertook both regulatory and non-regulatory approaches to address Giardia, *Cryptosporidium*, and viruses in surface waters. On the regulatory front, EPA developed a series of regulations aimed at controlling microbial contaminants. At the same time, EPA's Technical Support Center (TSC), a branch of EPA's Office of Ground Water and Drinking Water (OGWDW) located in Cincinnati, OH, developed a non-regulatory, proactive approach to microbial control that used optimization tools to focus on operational changes to improve water quality. This proactive approach has evolved into today's Area-Wide Optimization Program (AWOP). Through AWOP, both states and water systems can choose to pursue optimized levels of water quality towards

One of the most cost-effective ways a state can improve an existing plant's ability to protect public health is to optimize the performance of treatment technologies already in place.

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ASDWA Involvement in AWOP

In early 2003, EPA's Technical Support Center (TSC), a branch of the Office of Ground Water and Drinking Water, approached the Association of State Drinking Water Administrators (ASDWA) about the possibility of ASDWA becoming involved with the Area-Wide Optimization Program (AWOP). After discussing the options with TSC and the ASDWA Board of Directors, ASDWA entered into a cooperative agreement with OGWDW with a goal of building upon existing AWOP programs while at the same time expanding the program to other states that are interested in participating.

The first step in the process was to educate ASDWA staff about AWOP. This included reviewing existing documents, attending selected quarterly meetings, and participating in technical tool training.

Based on the knowledge gained, ASDWA has embarked on two educational efforts to expand the knowledge base about AWOP – a period electronic newsletter and an AWOP page on the ASDWA web site. ASDWA plans to work with TSC, Process Applications, Inc. (a contractor that provides technical support and develops tools for use in AWOP), and the existing AWOP programs to provide an electronic newsletter three times a year. The newsletter will provide information about the different regional AWOPs, describe AWOP tools and training opportunities, and spotlight a state or EPA Regional office and the benefits they have seen through implementing AWOP.

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Spotlight: Arkansas' Area-Wide Optimization Program

Each issue of *AWOP News* will focus on an individual state or EPA Regional office involved in an Area-Wide Optimization Program (AWOP), including the history of the program, challenges faced and lessons learned, and overall impacts of the program. This issue focuses on Arkansas.

History of the Arkansas Optimization Program

Arkansas' optimization program roots go back to 1995 when Division of Engineering management was first exposed to the concept of an optimization program in meetings with EPA Region 6 and ASDWA. Intrigued by the potential benefits of an area-wide optimization program, division management decided to develop an optimization program in 1996 and funded an engineer position to work on AWOP in 1997.

EPA Region 6 staff provided Comprehensive Performance Evaluation (CPE) training to Arkansas Department of Health (ADH) staff in three CPEs conducted in Arkansas in 1997 and 1998. In 1999, Arkansas sent staff to participate in an initial meeting in Oklahoma City, OK on AWOP. Staff from the states of Arkansas, Oklahoma, New Mexico, and Louisiana along with representatives from EPA Region 6, EPA's Technical Support Center, and Process Applications, Inc. attended the meeting. ADH staff attended additional AWOP quarterly meetings in 1999 and began development of tools to determine the performance status of surface water treatment plants in the state. Arkansas conducted three more CPEs in 1999. All three systems were under enforcement action for turbidity MCL violations. Exposure to the daily operation of water plants during the CPEs greatly increased ADH staff knowledge of treatment plant operations. After conducting the first six CPEs, ADH staff realized that all six systems had issues with calibration of turbidimeters and/or reporting of turbidity data.

In 1999, ADH hired a summer intern to help with the optimization program. The intern entered daily raw, settled, and peak finished water turbidity data from monthly operation reports for January 1998 through April 1999 into Excel spreadsheets. The 1998 data was graphed and the performance graphs were sent to each surface water system along with a copy of Arkansas' Optimization Criteria. The summer intern also checked the calibration of 50 turbidimeters at 19 plants. Only 46 percent of the turbidimeters were found to be properly calibrated.

In 2000, ADH staff conducted a detailed review of the December 1999 monthly operation report from each of approximately 95 surface water treatment plants. The emphasis on the detailed review was on data trends, such as data that simply looked too good to be true. Data from twenty plants were determined to be questionable and the plants were targeted for follow up activity including further data analyses, telephone contact, and site visits. Approximately half of the twenty plants were found to have significant problems with turbidimeter calibration, turbidity data collection, and/or turbidity data reporting.

Upon discovery of these problems, ADH staff developed a one-day training session on turbidimeter calibration and turbidity reporting. The one-day training session was conducted at eight locations across the state and the sessions were well attended.

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improved public health protection. While originally developed to address microbial contaminants, AWOP has expanded beyond the original tools and is an ever-changing and ever-growing program that now addresses both microbial contaminants and disinfection byproducts (DBPs) in surface water systems, and in the future, will address these issues at ground water systems.

What is AWOP?

An area-wide optimization program is an approach that states can use to prioritize their oversight of surface water systems to ensure that systems with the most need obtain the appropriate level of state attention. AWOP is designed to facilitate water system regulatory compliance by proactively building an awareness of the benefits of optimizing the particle removal and disinfection practices of existing treatment processes through more effective process control, which can result in increased protection of public health with limited need for major capital expenditures.

A state that chooses to implement an area-wide optimization program begins by developing its own criteria to prioritize surface water systems relative to one or more indicators of public health risk (such as turbidity or violations of microbiological rules). The state then uses the criteria to rank its surface water systems, thus creating a framework for applying available tools and resources to all surface water treatment systems within a defined area on a prioritized basis.

Although AWOP originally focused on optimizing microbial control, recent efforts have focused on disinfection optimization, including disinfection byproduct control. Just as new EPA regulations require public water systems to balance risks from microbial and disinfection by-product contaminants, AWOP provides the framework for states to address the public health challenges of microbial and disinfection by-product control concurrently.

The microbial control aspect of AWOP is well established. AWOP sets goals for conventional surface water treatment plants for settled water (either 1.0 NTU or 2.0 NTU depending on raw water turbidity levels), filtered water (0.10 NTU), and disinfection contact time (CT). Over the last 10 years, AWOP states have found that most surface water treatment plants can meet the goals without major capital expenditures.

Recent activity related to DBP control will allow plants to optimize existing disinfection practices and control DBP formation. Although chlorine is effective for many microbial contaminants, chlorine reacts with natural organic matter to form DBPs. AWOP is developing goals for DBP-related issues that focus on removing DBP-forming compounds, providing adequate disinfection, minimizing DBPs for all customers, and designing DBP tools that can be used by the current optimization programs.

CCP as the Basis for AWOP

The optimization framework is founded on the Composite Correction Program (CCP). The CCP approach identifies and addresses performance limitations at an individual facility in order to obtain improved performance through a two-step process: Comprehensive Performance Evaluations (CPEs) and Comprehensive Technical Assistance (CTA).

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The CPE phase is a thorough review and analysis of a facility's design capabilities and associated administrative, operational, and maintenance practices as they relate to achieving optimum performance from the facility. A primary objective is to identify performance-limiting factors and determine if significant improvements in treatment performance can be achieved without major capital expenditures.

The CTA phase follows the CPE and addresses the performance limitations identified in the CPE, and, by design, is plant-specific. One initiative developed from the CTA process is Performance-Based Training (PBT), which aims to improve plant performance in a cost-effective manner by training staff from multiple plants concurrently.

Components of an Area-Wide Optimization Program

AWOP consists of three strategic areas: Status; Targeted Performance Improvement; and Maintenance. In general, Status activities center on establishing the performance goals that the state will pursue and measuring the performance of plants against these goals. The focus of Targeted Performance Improvement is to determine which of the various assistance tools is appropriate for a given treatment plant and to implement the tool(s) in the most effective manner. Maintenance activities include using lessons learned from AWOP efforts to improve the state program. The intent of these three activities is to create a coordinated, dynamic state process that can be applied to a wide range of treatment plants.

Benefits of AWOP

The primary benefit of an AWOP is improved water quality at individual drinking water treatment plants. Other benefits of AWOP that contribute to this overall goal include:

- Systems receive the tools needed to comply with drinking water rules such as the Long Term 1 Enhanced Surface Water Treatment Rule, the Stage 1 Disinfectants/ Disinfection Byproducts Rule, and the Ground Water Rule (under development).
- Systems better understand their roles in treatment optimization as it relates to public health protection.
- A system operator's ability to apply new technical concepts is enhanced, resulting in sustained improvements in plant operation.
- New communication and networking opportunities for state and water system staff are created, which carries benefits over into other programs (such as capacity development, operator certification, construction standards, and plan review).
- The useful life of existing infrastructure is prolonged by optimizing performance, thereby reducing the need to invest scarce resources in new facilities to achieve compliance.
- Opportunities for professional development provide state personnel with skills and confidence in pursuing optimization activities at existing water treatment plants.
- States can effectively and efficiently use limited resources.
  Each state can review its efforts and integrate the lessons learned back into the area-wide optimization program as well as other state programs.

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Current Multi-State Area-Wide Optimization Programs

Although each state that designs an area-wide optimization program tailors the program to its state-specific needs, all existing state AWOPs were developed as part of facilitated regional multi-state programs. These regional multi-state programs allow for the efficient and effective transfer of technical materials as well as for state staff to work together (in some cases for the first time) to solve common implementation problems. Several times a year all of the states in a multi-state program come together to provide an update on their state program and share the lessons they have learned. After a multi-state meeting, each state decides whether, and if so how, to adjust its program based on the information gathered at the meeting. AWOP states have indicated that in many cases they learn as much from their peers as from the formal training. Additionally, these multi-state efforts allow states to assist each other throughout the year on various activities such as training state staff and dealing with specific regulation implementation issues.

In 1997 and 1999, EPA Regions 4 and 6, respectively, initiated multi-state AWOPs. Participating states in these regions include Alabama, Kentucky, Georgia, North Carolina, South Carolina, and Florida in Region 4 and Louisiana, New Mexico, Arkansas, and Oklahoma in Region 6. These states have completed the documentation of the Status and Targeted Performance Improvement components and are currently developing and documenting their Maintenance components. Additionally, these states are moving forward in development of a Status component for DBPs.

In 2003, EPA Regions 3 and 10 states started new multi-state efforts. Many of the states in these regions are currently determining their role in the process and beginning to develop their individual Status components.

Future Direction of AWOP

The future of AWOP is multi-faceted Efforts will focus on assessing and prioritizing state and treatment plant needs in order to develop pertinent materials that can be used to enhance public health protection and, correspondingly, meeting or exceeding regulatory requirements. Facilitation of implementation activities in existing multi-state AWOPs and expansion of AWOP to other interested states are also on-going priorities. Emphasis will continue to be placed on achieving documented improvement in performance from existing water treatment facilities on an area-wide basis. In 2003, OGWDW entered into a cooperative agreement with ASDWA designed to achieve these goals. For additional information on AWOP or how to get involved, please contact ASDWA (Matt Corson at 202-293-4640) or TSC (Jon Bender at 513-569-7227, Rick Lieberman at 513-569-7604, or Gwen Wise at 513-569-7874).

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The AWOP page on the ASDWA website will contain information relative to the AWOP program including tools, state and EPA Regional contacts, and state reports on the status of their program. The web page is currently under development and should be posted to the ASDWA web site in early Spring 2004.

Another task ASDWA will perform includes developing materials that capture state experiences in implementing a state AWOP. These materials will build upon the development of the existing multi-state and individual state area-wide optimization programs and should prove useful to gaining support for a state that chooses to develop a program.

ASDWA is also working to increase AWOP exposure at national meetings and possibly through web-based meetings. Two AWOP presentations were given at the 2003 ASDWA Annual Conference in Boston, MA. Chris Griffin (AL) made a presentation on AWOP in general and Doug Kinard (SC) made a presentation on South Carolina's AWOP program and the impact AWOP has had on their systems and water supply program. Both presentations received high marks on Conference Evaluation Forms. Additionally, ASDWA and TSC have discussed the possibility of conducting web-based meetings to allow states to discuss significant AWOP issues and share their AWOP experiences and tools they have developed.

ASDWA is open to suggestions of how to better support existing AWOP activities as well as expand AWOP to additional states that are interested in the program. This includes specific ideas on how to proceed with any of the activities discussed in this article as well as other activities beyond those listed. Please direct all questions or comments on ASDWA's involvement in AWOP to Matt Corson at ASDWA at 202-293-4640 or mcorson@asdwa.org. ■

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In 2002, ADH staff started a Performance Based Training (PBT) project that focused on plants challenged with meeting both turbidity and disinfection byproduct (DBP) limits. ADH staff gained experience in conducting PBT by attending training sessions being conducted in Louisiana and Texas. The training materials used for these sessions were used as the basis for most of the ADH sessions. ADH added one additional training session that focused on DBP data analyses and control strategies, disinfection contact time (CT) requirements, and the interrelation between DBP formation and meeting CT requirements. ADH staff conducted field trihalomethane sample analyses using the Hach THMPlus method every two weeks during the project to give the participating water systems prompt feedback on changes in plant operations. The PBT series was completed in one year. ADH is still providing THMPlus sample analyses to some of the participating water systems that are still working to reduce DBP levels.

From CPE and PBT experience, ADH staff determined that operators lacked an understanding of CT and that many systems were not correctly monitoring and reporting CT parameters. ADH staff also saw a need for operator training on DBP control strategies as well as a need to increase operators' understanding of the conflicts between CT requirements (more chlorine) and DBP control (less chlorine). ADH developed a two-day training session to address these issues with the first day focusing on CT requirements and the second day focusing on DBP control. A series of nine training sessions were conducted across the state. Approximately half of the surface plants in the state had one or more operators attend the training sessions and several consulting engineers also attended the sessions.

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Improvement in Plant Performance through AWOP

The overall goal of AWOP is to improve the performance of surface water treatment plants in the state. Figure 1 shows the number of plants meeting 95th percentile turbidity values for 1998 (the year prior to AWOP) and 2002. Relative to the new filtered water turbidity requirement of 0.3 NTU, the number of plants meeting this value increased from 55 to 71 over the period. Relative to the optimization goal of 0.10 NTU, the number of plants increased from 7 to 22.

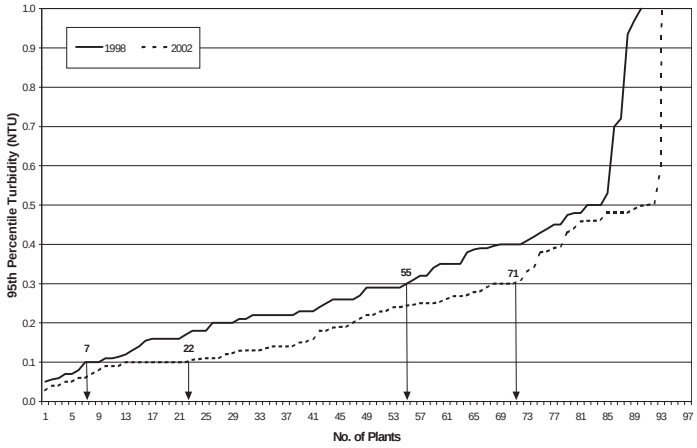

Figure 1. Performance Trends for Arkansas Water Systems over 5 Year Period

The performance charts shown in Figures 2 and 3 highlight one of the eight water systems participating in the PBT series. Seven of the eight water systems showed at least some improvement in water quality (the eighth plant was already close to meeting optimization goals). Figures 2 and 3 are from the water system with the most dramatic improvements in water quality. Figure 2 shows the improvement in filtered water turbidity following initiation of the training. Except for a few excursions, this plant is routinely meeting the 0.10 NTU Optimization Goal in their filtered water. The disinfection byproduct performance of this same plant is shown in Figure 3. As the graph indicates, this plant is now consistently meeting the TTHM and HAA5 regulatory requirements of 80 and 60 mg/L, respectively.

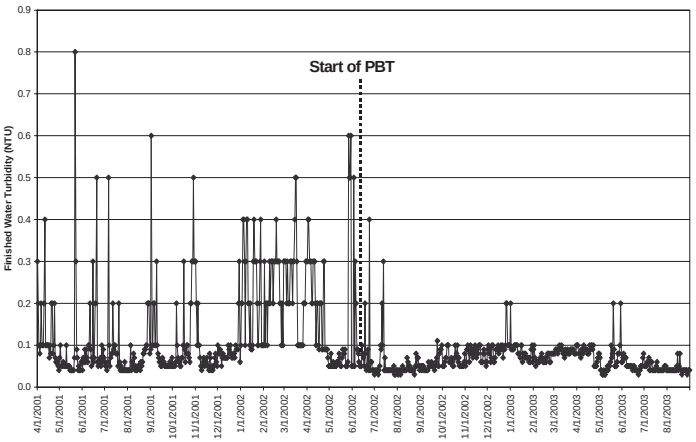

Figure 2. Finished Water Turbidity Trend for PBT plant

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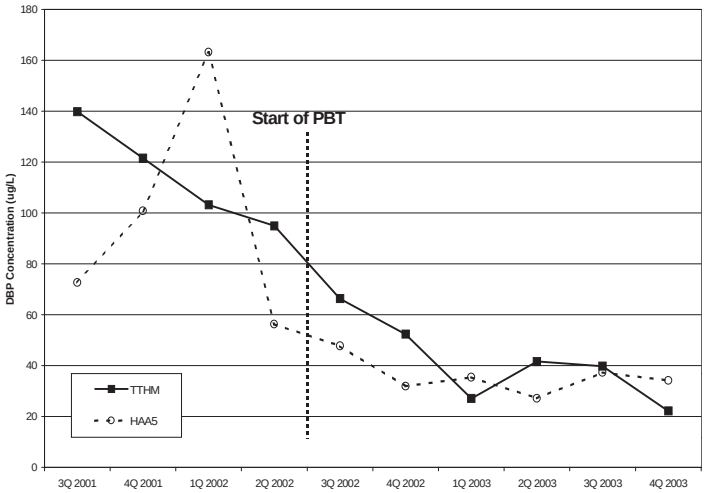

Figure 3. DBP Performance Data for PBT plant

Impact on ADH

Although implementation of the AWOP in Arkansas has taken some of the resources available for the drinking water program (between 2 and 3 full time equivalent positions), the following benefits have been realized by both ADH and the state of Arkansas:

- ADH staff has established better working relationships with water system staff.
- ADH staff has spent more time in water treatment plants and has a better understanding of the day-to-day operation of surface water treatment plants.
- ADH has been able to identify generalized areas of weakness in performance by water system staff and provide training targeting those areas.
- ADH staff is more capable of identifying operational problems during sanitary surveys or other contact with water systems.
- ADH is receiving more accurate data on monthly operation reports than the data received prior to initiating some of the AWOP activities.
- ADH staff is better able to provide technical assistance to water systems challenged with meeting new Federal regulations.
- Through AWOP, ADH staff has learned different training and technical assistance techniques that can be used in non-AWOP activities.
- The final and most important benefit realized is improved drinking water quality for the citizens of the state of Arkansas.

AWOP Quarterly Meetings Update

One of the key components of a multi-state area-wide optimization program (AWOP) is the quarterly meeting held between participating state program personnel, EPA, ASDWA, and the contractor, Process Applications, Inc. These meetings are part of the strategic implementation process used to sustain AWOP activities and accomplish multiple objectives:

- Forum for sharing of ideas
- Mechanism for agreeing on direction and priorities
- Method for providing multi-state support and encouragement to improve program performance
- Procedure for sharing technical and management information and approaches

The "quarterly schedule" is somewhat flexible and may range from three to four times per year. Often the meetings are supplemented with technical workshops or on-site activities at plants. The training component of the quarterly meetings ranges from short presentation workshop sessions of several hours up to on-site training events that are conducted over one to four days. The quarterly meetings use a formalized process for identifying and discussing topics. Each event is followed up with action items for all of the participants. Progress on the action items is reported at the next quarterly meeting. Region 4 and Region 6 have been meeting for several years and have comprehensive AWOP programs in place. Regions 3 and 10 have initiated AWOP activities within the last year and are focusing on implementing the AWOP components. Following is a brief synopsis of the recent quarterly meetings in each Region.

Future activities are scheduled as follows:

Dates	Activity
Week of March 8, 2004	Region 3 Multi-State Quarterly Meeting – Pennsylvania
Week of March 8, 2004	Region 10 Multi-State Quarterly Meeting – Washington
Week of May 10, 2004	Region 3 Multi-State Quarterly Meeting – TBD
Week of May 10, 2004	Region 6 Multi-State Quarterly Meeting – Louisiana
Week of July 12, 2004	Region 4 Multi-State Quarterly Meeting – South Carolina
Week of July 12, 2004	Region 10 Multi-State Quarterly Meeting – Idaho
Week of August 9, 2004	Region 6 Multi-State Quarterly Meeting – Colorado
Week of November 1, 2004	Region 6 Multi-State Quarterly Meeting – New Mexico
Week of November 15, 2004	Region 4 Multi-State Quarterly Meeting – Kentucky

The most recent two meetings for Region 4 and 6 have focused on data collection techniques to evaluate a plant relative to optimizing disinfection and disinfection byproduct performance. Training was provided on using the data collection spreadsheets developed by EPA's Technical Support Center and Process Applications, Inc. The first meeting of this series also provided insight and training on using a process control test to assess trihalomethane formation in the plant and distribution system. The second meeting of the series repeated the use of the data collection spreadsheets as well as introduced enhanced coagulation jar testing and use of UV 254 as an operational surrogate for TOC.

Regions 3 and 10 are focusing on developing their status component; that is, a systematic approach for prioritizing their plants relative to public health risk. Once these activities are in place, training and development of performance improvement approaches will be pursued. ■